



Norfolk Southern Corporation  
Communications & Signal Department  
1200 Peachtree Street, N.E. - Box 123  
Atlanta, Georgia 30309

B. L. Sykes  
Chief Engineer C&S Engineering

April 20, 2009

Jo Strang  
Associate Administrator for Railroad Safety  
Chief Safety Officer  
Federal Railroad Administration  
Office W35-328  
1200 New Jersey Avenue, SE  
Washington, DC 20590

Dear Ms. Strang:

Attached is a waiver request pertaining to Norfolk Southern's desire to deploy a new device for automated execution of certain FRA required test made at interlocking and control points on the Norfolk Southern system. The FRA's consideration in this matter is appreciated.

If you have any questions, please do not hesitate to contact Brian Sykes at 404-529-2105.

Sincerely,

A handwritten signature in cursive script that reads 'B. L. Sykes'.

B. L. Sykes

Enclosure

Docket Clerk  
Federal Railroad Administration  
400 Seventh Street  
Washington, DC 20590

Norfolk Southern Railway Company (NS) wishes to deploy its InterTest® automated interlocking testing system which automates the performance of Federal Railway Administration (FRA) required two year testing at NS's control points and interlockings. In addition, NS wishes to implement use of the subject automated system for performing in service tests on wayside signal systems in traffic control and automatic block signal territories. In its accomplishment of FRA required testing of interlockings and control points, the automated system will perform at a minimum all tests that are currently required to be performed by human interaction with the control point or interlocking hardware under NS's present test procedures. In accomplishment of in service testing of wayside signal systems, the automated system will perform at a minimum all tests and signal checks that are currently required to be performed by human interaction with the wayside signal system hardware under NS's present test procedures. This letter also requests that NS be granted a waiver for use of electronic signature that is an available feature of the automated testing system. This letter will briefly describe the automated testing system, identify the regulations with which the automated system will perform automated testing, and describe how use of the tester conforms to the applicable regulations, and answer safety concerns relative to the request for implementation.

### **System Description**

The InterTest® system is a processor based system that performs testing by electronically exercising the inputs to the interlocking locking circuitry in a manner which replicates that done by humans during a manual test. The interlocking tester consists of three subsystems that are tied together by a central control computer. The first subsystem consists of connectivity blocks that are mounted on entrance rack making an in line connection on one side of the circuit for each of the field devices such as track circuit, signal aspect, and switch indication circuit. With use of the connectivity blocks making connection to field devices at the entrance rack, the automated system is able to determine if a change of state with a field device has taken place such as change in display of a signal aspect, and also permits the tester to force a desired change of state such as shunting of a track circuit or dropping of a switch correspondence relay. The second subsystem is the draw layout program which permits the user to enter the physical layout of the interlocking into the testing software. The entry of physical layout includes entry of all field elements such as power switches, signals with their aspects, track circuits, each entered in sequence such that draw layout contains an accurate physical and logical representation of the interlocking layout. The entry of the physical layout includes entry of appropriate configuration information for each configurable element within an interlocking such as aspects that are available on a given signal head, and includes configuring the relationship that an element has with each adjacent element in a manner that results in entry of an aspect chart. Information entry into draw layout encompasses entry and configuration of all information required for determining what routes are present in the layout, and generation of complete and accurate test scripts (test steps) which is performed by the run layout subsystem. This third subsystem run layout formulates test scripts and executes these scripts in performance of the test. Run layout merges together the previously entered physical layout and configuration information from draw

layout along with previously stored generic test scripts for various route configurations to formulate test steps needed to perform all applicable locking tests on a specific physical layout that has been entered. Along with formulation of test scripts, run layout contains the logic that allows execution of the test scripts by the test system, and monitors field devices to determine if actual responses correspond with expected responses. Run Layout displays, records and stores test results. Two other adjunct devices that the tester uses are separate radio interfaces which allow adjacent signal locations to communicate with the central control computer, and which allow hand held devices used for initial field device state verification to communicate with the central control computer.

### **System Operation**

The first step in preparing for testing of a control point, interlocking or series of adjacent locations comprising a wayside signal system is logging into the test system. To commence any of the steps required for use of the tester to test an interlocking, control point or wayside signal system, the user must log in to the central computer using a unique user ID and password. Once log in has been done successfully, the first step of entry of the physical layout can be progressed. This step includes entry into the tester database in proper sequence the track, signal and switch components of the territory that is desired to test. Entry of physical layout also requires entry of all configuration information associated with components being entered. Given the criticality of complete and accurate entry of all relevant configuration information, this task must be done by qualified personnel familiar with all aspects of interlockings and their testing requirements. A task that can be done at any time prior to performance of testing is the mounting of the Control Point Interface's (CPI's) on the cable entrance rack. Once entry is made of the physical layout of the territory into the draw layout program, the tester will print out a listing of required Control Point Interface and the circuits where installation of these blocks is required. There are different types of CPI's used in accordance with the type of circuit being monitored or controlled, with each block having its own unique IP address used by the system to permit exercising of the correct input during testing. Once the Control Point Interface's are installed on their respective circuits, the tester utilizes a bar code scanner to correlate a given Control Point Interface to a specific circuit. To do this, each hardware element of the test system must be connected together to comprise the test system. Included among the hardware of the test system is a code emulator device that is connected to the coding unit of any control points under test displacing dispatcher control once testing commences. Once the physical layout along with associated configuration information is entered into draw layout, other required test specific information is entered by the user, such as what FRA tests the user desires to run. Included in this selection is whether or not the user desires each type of locking test to be run individually or if the user desires locking tests to be run as a composite test. Once this information is provided, a command is executed for the test system to generate test scripts. Once generated, these test scripts are checked for accuracy by qualified personnel. If the test scripts are found to be accurate, the next step is field verification of components. As a prerequisite to testing, manual verification must be made of each field device to insure that the test system is properly connected to these devices. This verification involves manual exercising of field devices and insuring that the device being exercised correlates with devices that the tester identifies as being exercised, with the tester also insuring that all devices including all signal aspects, switch positions, and track circuits are seen in each valid state. Once verification is complete, other required steps can be taken to allow

commencement of testing, such as obtaining of track authority, disabling of crossings, connection made to code emulators, and other steps.

### **Conduct of the Test**

Once testing commences, the tester utilizes a log screen to monitor testing progress. Testing is done by route in sequence, and testing can be monitored in the manner of viewing each test step being performed and results of each of these tests. If desired, testing can be suspended (paused), then later restarted to coincide with the point at which testing was paused. Testing can be manually single stepped to allow the user to evaluate responses of field devices, if desired. When there is a failure of a test step, a message is displayed which notes the failure and provides reasons for the failure to the extent that this information is available to the system. Once testing has been completed, the system will provide a summary of the test including a tabulation of passed and failed test steps. If there are no failures of any of the test steps, the test system is able to electronically store on NS's prescribed form the results of the tests. Included in this storage is the log in name of the person performing the test.

### **Requirements for In-Service Test**

When testing a signal system as part of an in service test, there are additional requirements that must be met. Included in these additional requirements are continuous testing of grounds, performing light out checks, observing of signal aspects in both directions during simulation of train movements across the territory under test, observing of signal aspects in both directions during dropping of out of the sky shunts on all track circuits across the territory under test, observing of signal aspects in both directions during opening of hand throw switches for all hand throw switches within the confines of the territory under test. The tester provides test scripts covering these tests at the time of test script generation if in service testing is specified during configuration. As with the other tests, these test scripts must be verified for accuracy by qualified personnel prior to commencing the test.

### **Other Measures taken to insure safety and accuracy of testing**

As stated, field verification must be made by the user prior to testing to insure that the tester is properly connected to the field devices. The tester utilizes a checklist that requires the user to check off that verification has been made of each field component such as signal aspect, track circuit, and switch correspondence relay prior to commencing the automated test. In this manner, assurance is provided that there is an exact match between what component the tester software configuration shows as being connected to versus that component to which it is actually connected. At the point at which the tester generates test scripts, the tester provides a listing of routes that are present and the test steps that are needed to perform the prescribed locking tests on each of these routes. A qualified user must check these route lists along with the test scripts for completeness and accuracy. Testing cannot commence unless and until this step has been completed. The tester has a checkbox that must be completed to indicate that this step has been successfully completed prior to commencing the locking test. The software that is used with InterTest® is part of NS's software management control plan which provides for version control and documentation.

### **Enhanced Safety as Compared to Present Test Methods**

The primary benefit of use of this system is enhanced safety for testing of signal systems on NS. Safety is enhanced for three primary reasons. The first reason is standardization of the test process. Today on NS there is no system wide standard for formulation of test sheets, and there is variation among territories regarding the format and content of test sheets formulated for interlockings of similar design. The automated tester provides test sheets that are standardized both in format and in content. This is made possible by the tester's automated test sheet generating process that formulates test sheets using standard algorithms and formulas. The result is generation of test sheets that are standardized in both format and content, and which are therefore wholly consistent from location to location. This standardization results in consistency that eliminates the potential for inadvertent omission of test steps or errors made in test step content both of which are possible with human formulation of test procedures. The second reason is removal of human factor in monitoring of interlocking components during testing. The tester continuously monitors all interlocking components such as track circuits, signal aspects and switch positions during testing. Components are continuously monitored even when they may not be directly involved with the route or area of the interlocking being tested. These factors permit the automated tester to deliver a more thorough test, eliminating the possibility that wiring errors having safety implications go undetected during the test process as is possible with human monitoring of signal components during testing. The final reason is removal of human factor in executing of test steps. The computer executes test steps in sequence from the formulated procedure and requires that each step be successfully executed in their predetermined sequence. The successful completion or failure of each test step is documented, and failures of any test steps are immediately flagged to the user in the form of an error message that appears on the diagnostic screen. These factors permit the tester to deliver a complete and accurate test eliminating the potential for an incomplete or inaccurate test owing to inadvertent omission of test steps or misinterpretation of test step results that is possible with human execution of the test procedure.

### **Fail Safe Principles employed in Tester Design**

The automated tester utilizes fail safe software design that forces the tester to a safe state when system software or hardware errors are detected. The software utilizes industry standard processor performance monitoring methods to determine when hardware or software failure conditions occur such as database or message corruption, processor halts, and infinite loops. When any abnormal software or hardware condition is detected, the tester immediately halts the testing process with appropriate error messages conveyed to the user. The control point interface (CPI) devices that are permanently mounted on the cable entrance rack are designed using the fail safe principle. The devices are inserted into each circuit using a normally closed contact. If a contact fails in the closed position, this failure is detected by the tester when the tester attempts to perform a test that requires the contact to open. If a contact fails in the open position, the signal system detects this as an open circuit with its resultant restricting signals. In a few unusual circumstances, CPI's utilize the normally open contact, but application rules prevent use of CPI's in this manner except in situations where a malfunction will not result in an unsafe side failure of grade crossing warning or wayside signal systems. The fail safe principle is employed throughout the design of the tester as failure of any connection on any of the hardware components used by the tester, whether an open circuit or a short, will result in failure of the tester. The tester employs the non-vital portion of the interlocking hardware in execution of the

test process. The tester utilizes the control capabilities of the interlocking's TC coding unit in attempting to line opposing signals and move switches during locking tests. Similarly, the tester utilizes the indication capabilities of the interlocking's TC coding unit in attempting to determine if signals clear or switches move during locking tests. During testing, there is a continuous variation in the expected responses, with the tester having predetermined expectations regarding the response of each element along with the sequence and timing of these responses. When the response of any element does not match expectations with regard to state, sequence, or timing, the tester flags the user. Given the quantity of required responses during testing and the critical requirements regarding sequence and timing of these responses, any failure of the any portion of the hardware, even if momentary or intermittent, is immediately detected and flagged to the user.

### **Compliance with FRA Rules**

The automated testing system design contemplates automated performance of test steps identical to that which is currently performed manually using human intervention. The tester makes no attempt to omit, circumvent, exclude, negate, or forgo any test step that is currently included in any of the locking tests that are currently performed manually. The tester utilizes a complete and accurate compilation of test steps and executes these test steps in a precise manner, documenting the results of each step. Listed below are the tests that the tester performs and the methodology used to accomplish these tests.

#### **TWO YEAR TEST**

##### Rule

**49CFR§236.378 – Time Locking** – Time locking shall be tested when placed in service and thereafter when modified, disarranged, or at least once every two years, whichever shall occur first.

##### Response

The tester will perform the prescribed time locking test on all switches in all routes within the interlocking under test. Tests are performed in orderly and logical manner with the user able to view the execution of each test step. If there is a failure in the tester's execution of any test step, or if the tester detects any other unintended status of any component during the test, the tester flags the user and/or fails the test as appropriate.

##### Rule

**49CFR§236.379 – Route Locking** – Route locking or other type of switch locking shall be tested when placed in service and thereafter when modified, disarranged, or at least once every two years, whichever shall occur first.

##### Response

The tester will perform the prescribed route locking test on all switches in all routes within the interlocking under test. Tests are performed in orderly and logical manner with the user able to view the execution of each test step. If there is a failure in the tester's execution of any test step, or if the tester detects any other unintended status of any component during the test, the tester flags the user and/or fails the test as appropriate.

Rule

**49CFR§236.380 – Indication Locking** – Indication locking shall be tested when placed in service and thereafter when modified, disarranged, or at least once every two years, whichever shall occur first.

Response

The tester will perform the prescribed indication locking test on all switches and controlled signals in all routes within the interlocking under test. Tests are performed in orderly and logical manner with the user able to view the execution of each test step. If there is a failure in the tester's execution of any test step, or if the tester detects any other unintended status of any component during the test, the tester flags the user and/or fails the test as appropriate.

IN SERVICE TEST

Rule

**49CFR§236.201 - Track circuit control of signals** – The control circuits for home signal aspects with indications more favorable than "proceed at restricted speed" shall be controlled automatically by track circuits extending through the entire block.

Response

The tester will perform the required tests to insure that track circuits control the display of permissive signal aspects. Tests are performed in orderly and logical manner with the user able to view the execution of each test step. If there is a failure in the tester's execution of any test step, or if the tester detects any other unintended status of any component during the test, the tester flags the user and/or fails the test as appropriate.

Rule

**49CFR§236.202 – Signal governing movements over hand operated switch** – Signal governing movements over hand operated switch in the facing direction shall display its most restrictive aspect when the points are open one-fourth inch or more and, in the trailing direction, three eighths inch or more, except that where a separate aspect is displayed for facing movements over the switch in the normal and in the reverse position, the signal shall display its most restrictive aspect when the switch points are open one-fourth inch or more from either the normal or reverse position.

Response

The tester will perform the required tests to insure that the position of hand throw switches control the display of permissive signal aspects. Tests are performed in orderly and logical manner with the user able to view the execution of each test step. If there is a failure in the tester's execution of any test step, or if the tester detects any other unintended status of any component during the test, the tester flags the user and/or fails the test as appropriate.

Rule

**49CFR§236.204 – Track signaled for movements in both directions, requirements** – On track signaled for movements in both directions, a train shall cause one or more opposing signals immediately ahead of it to display the most restrictive aspect, the indication of which shall not be more favorable than "proceed at restricted speed".

Response

The tester will perform the required tests to insure that the presence of a train in a signal block shall cause the opposing signals in advance of the movement in the block to display their most restrictive aspects. Tests are performed in orderly and logical manner with the user able to view the execution of each test step. If there is a failure in the tester's execution of any test step, or if the tester detects any other unintended status of any component during the test, the tester flags the user and/or fails the test as appropriate.

Rule

**49CFR§236.402 – Signals controlled by track circuits and control operator** – The control circuits for home signal aspects with indications more favorable than “proceed at restricted speed” shall be controlled by track circuits extending through entire block.

Response

The tester will perform the required tests to insure that track circuits control the display of permissive signal aspects. Tests are performed in orderly and logical manner with the user able to view the execution of each test step. If there is a failure in the tester's execution of any test step, or if the tester detects any other unintended status of any component during the test, the tester flags the user and/or fails the test as appropriate.

Rule

**49CFR§236.403 – Signals at Control Point** – Signals at control point shall be so interconnected that aspects to proceed cannot be displayed simultaneously for conflicting movements, except that opposing signals may display an aspect indicating “proceed at restricted speed” at the same time on a track used for switching movements only, by one train at a time.

Response

The tester will perform the required tests to insure that permissive aspects cannot be displayed for conflicting movements. Tests are performed in orderly and logical manner with the user able to view the execution of each test step. If there is a failure in the tester's execution of any test step, or if the tester detects any other unintended status of any component during the test, the tester flags the user and/or fails the test as appropriate.

Rule

**49CFR§236.404 – Signals at adjacent control points** – Signals at adjacent control points shall be so interconnected that aspects to proceed on tracks signaled for movements at greater than restricted speed cannot be displayed simultaneously for conflicting movements.

Response

The tester will perform the required tests to insure that permissive aspects at adjacent control points cannot be displayed simultaneously for conflicting movements. Tests are performed in orderly and logical manner with the user able to view the execution of each test step. If there is a failure in the tester's execution of any test step, or if the tester detects any other unintended status of any component during the test, the tester flags the user and/or fails the test as appropriate.

Rule

**49CFR§236.405 – Track signaled for movements in both directions, change of direction of traffic** – On track signaled for movements in both directions, occupancy of the track between opposing signals at adjacent control points shall prevent changing of direction of traffic from that which obtained at the time the track became occupied, except that when a train having left one controlled point reaches a section of track immediately adjacent to the next controlled point at which switching is to be performed, an aspect permitting movement at not exceeding restricted speed may be displayed into the occupied block.

Response

The tester will perform the required tests to insure that occupancy of a track between control points shall prevent the changing of the direction of traffic between the control points. Tests are performed in orderly and logical manner with the user able to view the execution of each test step. If there is a failure in the tester's execution of any test step, or if the tester detects any other unintended status of any component during the test, the tester flags the user and/or fails the test as appropriate.

Rule

**49CFR§236.107 – Ground Tests** – A test for grounds on each energy bus furnishing power to circuits, the functioning of which affects the safety of train operation, shall be made when such energy bus is placed in service, and shall be made at least once every three months thereafter.

Response

The tester will perform the continuous monitoring of grounds during testing to insure that no ground with a current level above a predetermined level appears on any energy bus during testing. If a ground appears at any time during testing the tester suspends testing, providing appropriate error messages to the user. To resume testing, the user must identify and eliminate the source of the ground. ?

### **Electronic Signature**

Upon completion of tests, the tester stores each test result in the system's electronic storage medium. Included in the storage is the identification of the person making the test in accordance with the log on that was made at the time the test system was activated. The log on that is made includes the use of user ID and password that is unique to each user. This letter requests the FRA's approval in use of electronic signature in the storage of test results as described.

### **Software Version Control**

The software of the test system will conform to the requirements of version control as specified in NS's Software Management Control Plan (SMCP). This includes registering of each test system in a tracking database with this database including information on the currently utilized software version and revision level. As outlined in NS's SMCP, version control procedures will be in place to insure that version and revisions are kept current for all serviceable test systems, and any changes in version or revision levels are appropriately documented in the tracking database.

### **Access Control for Draw Layout and the Configuration Database**

Tester configuration at the time of setup must be performed by personnel having in depth knowledge of signal system design. This configuration includes specifying aspects to be displayed in various situations, aspects having light out protection, and other site specific attributes of a location being tested. This information is stored within the draw layout program's configuration database along with the physical layout information for a given track layout. The tester invokes controls to insure that only qualified personnel are permitted to make changes to the configuration database. To accomplish this, qualified personnel are provided a special administrative log-on to permit access to the configuration database. This administrative log on also captures the user ID of the person logging on. The system documents the log on identity of personnel making changes to the configuration database, and also documents the nature of these changes.

### **Change Control for Draw Layout and the Configuration Database**

The tester will employ a Cyclic Redundancy Check (CRC) as verification to the user whether or not any changes have been made to draw layout and the configuration database at a specific site since time of previous test. This CRC will be used to determine whether or not any changes have been made to any of the elements that define what tests are required at a specific site, such as the track layout, aspect chart, and signal attributes. The CRC that is computed at the commencement of testing at a specific site will be electronically recorded along with test results at the completion of testing so that it can be referred to when future tests are performed at that site.

### **Training**

Prior to systems being deployed, training will be held to insure that users understand how the system works and steps needed to perform tests. This training includes explanation of steps required for setup and monitoring of testing, as well as review of test results and storage of test results.

The following information is submitted in accordance with the provisions contained in 49CFR§211.9:

(1) Corporate Name of Applicant

Norfolk Southern Railway Company

(2) Manner in which Applicant is Involved

Norfolk Southern Railway is the owning carrier that will implement the use of the InterTest® Interlocking Tester System on its property.

(3) Location of Project

The InterTest® Interlocking Tester System will be implemented system wide on Norfolk Southern Railway.

(4) Tracks Involved

All Main Tracks, Sidings and auxiliary tracks that operate under traffic control and automatic block signal rules shall be included in the scope of this project.

(5) Description of Proposed Relief Sought

Norfolk Southern requests FRA's approval of use of the InterTest® Interlocking tester system to perform FRA required testing on Norfolk Southern Interlockings, control points, and wayside signal systems. Approval from FRA is sought to permit Norfolk Southern's use of the automated test system for subject testing in lieu of tests being performed manually. In Norfolk Southern's use of the tester to perform FRA tests, Norfolk Southern is making no attempt to omit, circumvent, exclude, negate, or forgo the performance of any test on interlockings, control points or wayside signal systems that is currently performed manually in any 2 year or in service tests. With this being the case, other than the rule cited below, this letter is not requesting relief from the provisions of any FRA rule or subrule, only approval of Norfolk Southern's use of the InterTest® System which involves automated execution of test steps. Norfolk Southern is not aware of any requirement in applicable FRA rules or subrules that specifies tests be performed manually with human execution of test steps.

49CFR§236.110 Results of Tests

Relief is requested from the requirements contained in the above regulation, identified by CFR part, section and heading. Permanent relief is sought to permit use of electronic signature for documentation and storage of results of tests performed during 2 year and in service testing. This request is to permit deployment of a feature of the InterTest® Interlocking Test System which electronically records and stores test results and correlates with the identity of the person making the test. The information recorded includes name of railroad, place, date, name of test performed, applicable FRA rule, equipment tested, results of tests, repairs and replacements made (if applicable), and condition which the apparatus was left. The test result being recorded is correlated with the identity of the person making the test by referencing the secure log on made at the time of tester setup.

(6) Justification for Relief From Requirements

Electronic signature is feature that is incorporated with use of the InterTest® System. Use of electronic signature with this system eliminates the risk of recording errors that can occur with manual (human) recording of test results. The use of the InterTest® system will enhance the safety by improving the content and accuracy of test steps used to accomplish 2 year and in service testing of interlockings, control points, and wayside signal systems.

(7) Approximate Dates of Deployment of InterTest® System

The InterTes®System has undergone successful rigorous testing at three revenue sites on Norfolk Southern. The test system is ready for deployment at this time and its use will commence upon FRA approval. Norfolk Southern's target date for system wide deployment of the InterTes®system is June 1, 2009.

(8) Changes in Operating Practices

The current methods of performing 2 year and in service testing will change only in that the InterTes®automated system will be used to execute test steps and observe responses rather than this being done by a human interaction as is the current practice. All other operating practices pertaining to performance of 2 year and in service testing will remain unchanged. Employees charged with use of the tester will be trained on its use.

(9) Effect on Safety of Operations

The use of the InterTes®System in the performance of 2 year and in service tests will have no adverse affect on safety of operations. The current methods of operation for testing of signal systems will remain in affect and all FRA required tests will be performed and recorded has been done in the past. Use of the automated test system will enhance safety due to the tester's improving the content and accuracy of test steps.

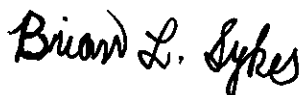
(10) Conformance with FRA Rules and Regulations

The use of the InterTes®System in the performance of 2 year and in service tests will comply with all FRA Rules and Regulations except those that are waived by the FRA. All FRA required tests will be performed and recorded as has been done in the past. Test results will be retained for specified time periods in accordance with FRA requirements.

Conclusion

Norfolk Southern stands ready to provide the FRA any additional information or clarification to expedite approval of this request. Norfolk Southern would appreciate accelerated review and processing to allow this system to be deployed in a timely and efficient manner. Norfolk Southern appreciates the FRA's support in our efforts to utilize modern technology to assist in improving the safety wayside signal systems as well as the processes used to test them.

Respectfully Submitted,

A handwritten signature in black ink that reads "Brian L. Sykes". The signature is written in a cursive, slightly slanted style.

Brian L. Sykes  
Chief Engineer, C&S Engineering  
Norfolk Southern Corporation